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# USSR Report

## MILITARY AFFAIRS

(FOUO 24/79)

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U.S. SHIP REPAIR OPERATIONS REVIEWED

Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 4, Apr 79 signed to press 6 Apr 79 pp 65-68

[Article by Capt 1st Rank (ret) B. Osipov and Engr-Capt 2d Rank A. Fedurin: "Providing for the Repair of Ships During Combat Operations: Based on Experiences From the Vietnam War"]

[Text] During the aggressive war in Vietnam the U.S. Navy command involved the considerable forces of the 7th Fleet in military operations. Along with ships of the major classes, a large number of launches (in 1968--800 and during the last years--about 2000) were used in the war.

Ships of the major classes participated in military operations according to a definite cycle. They were replaced by other ships and went to military naval bases located on the U.S. continent for repair and dry-dock at naval shipyards or private ship-repair enterprises (SRP). Temporary repairs were made in SRP located on the territory of American forward naval bases.

Carriers spent a considerable portion of their stay as part of the 7th Fleet (78-80 percent) at sea, participating in the combat operations against Vietnam. Thus, the "Enterprise" nuclear powered aircraft carrier spent 201 days at sea from October 1965 to June 1966 and 37 in the ports of Southeast Asia. During this period, the longest time of uninterrupted stay at sea on one-trip was 50 days.

In spite of the fact that ships and launches were used intensely, they were maintained at high combat readiness by regular repairs, dry docking, and the necessary technical maintenance and logistics support.

Providing repairs for major class ships. Repair and dry docking of ships were conducted by SRP in American forward naval bases in Yokosuka and Sasebo (Japan), Subic Bay (Luzon, Philippine Islands), Apra Bay (Guam, Mariana Islands), and in the main base of the U.S. Pacific Fleet, Pearl Harbor (Hawaiian Islands).

Ships of all classes and submarines, were repaired in Yokosuka. Six dry docks were used. "Forrestal" - class carriers were docked in one of them. About 2500 people worked in the SRP.

Repairs of carriers and ships having a large displacement were carried out in Sasebo. The ships were docked in three dry docks (the length of the biggest one was 260 meters). In the SRP, there was one stationary cargo crane (its lifting capacity was 250 tons).

Ships of all classes were repaired in the SRP of the Subic Bay base where 5,000 people worked by the end of the war. Five floating docks (PD) were earmarked for docking ships: a self-contained large (four sections with a total lifting capacity of 40,000 tons), two non-autonomous medium (18,000 tons each) and two self-contained small (1,000 and 1,900 tons respectively).

The ship repair enterprises on the island of Guam performed various repair operations on ships of the major classes. The ships were dry docked in three self-contained PD--a medium one (lifting capacity of 18,000 tons), a small one (1,000 tons) and a repair one (4,000 tons). More than 2,000 people were employed there.

Ships of all classes were drydocked and repaired in the ship repair dry docks at the main base of the Pacific Fleet, Pearl Harbor. About 5,000 people serviced it.

Based on foreign press reports, the four U. S. Navy ship repair drydocks, located on the western coast of the American continent in the cities of Bremerton, Vallejo, San Francisco, and Long Beach, played a considerable role in ensuring the combat readiness of the ships. They have a developed network of berths, equipped with cargo cranes, numerous repair workshops, and dry and floating docks.

Providing repairs for vessels with small displacements. Ships, which operated in the coastal regions of Vietnam and its river basins, especially the Mekong River, were sent to shore-based repair bases in South Vietnam where repair capabilities were limited. In spite of this, the American command continuously built up the number of combat and auxiliary launches operating in Vietnam. This caused definite difficulties in their maintenance. Problems also arose in connection with the mixture of hulls, made from steel, aluminum alloy, wood, and fiberglass as well as from the variety of engine types.

The intensive operation of the launches (they were on patrol about 4,000 hours a year and their engines worked 5,000 hours annually) forced them to perform the necessary technical maintenance and repairs on them where they operated.

A system of 14 repair bases was created in Vietnam to provide repairs, technical maintenance, supplies and basing. It included: a central rear area supply and repair base (at the plant level), intermediate ones--for emergency and routine repairs of the launches attached to them, and forward operational ones in which launches were repaired, underwent technical maintenance, were supplied with the necessary allowances, and were based.

The forward operational bases (mobile) were floating centers for servicing patrol and river boats. The first of these bases was created in January 1968 in the area of Danang. Eighty specialists and repairmen worked here. Floating pontons and then barges were used at first for the repairs and technical, maintenance of the launches. The headquarters of the launch large unit; the work and living premises for personnel and repair workers; depots for food, water, and fuel; repair workshops; and warehouses for spare parts and materials were located on them.

A total of 200-250 people could be accomodated at the same time on one barge earmarked for the rest and relaxation of personnel in a division of ten launches.

At the end of 1967, three complexes of floating repair bases were constructed in the United States for the forward operational bases. They were four non-self-propelled barges which supported a division of launches on each one.

The first barge (headquarters) had the communications equipment, officers cabins, sick-bay, ammunition magazine, an emergency diesel generator, and water purification equipment; the second--(housekeeping) had a galley, messhall, an air conditioning set common to all barges, an electrical station with two diesel generators (capacity of 150 kilowatts each) and living quarters for 27 enlisted men; the third (living)--crew quarters for 130 enlisted men, rest areas, equipment for purifying water, a laundry, and a landing and take-off pad for helicopters (on the upper deck); and the fourth (floating workshop) -- repair shops, a charging station for starter batteries, cargo handling gear for raising launches to the deck so as to repair and inspect their underwater portion, and two diesel generators.

Each barge (length--33.5 meters, width-- 9.1 meters, and draft-- 2.1 meters) consisted of four similar ponton sections with superstructures which, depending on their purpose, had external differences. The ponton sections were transported by sea on "Thomaston" dock landing ships and attack cargo ships to the place of their assignment where the barges were assembled on them while floating. In order to lessen the weight of the hulls of the barges, corrugated sheet steel (6.35 mm thick) without stiffening ribs was used in their construction.

American specialists point out, as a positive feature of these floating repair base complexes, their mobility which permitted them to be moved as the areas of the launches' combat operations shifted. This decreased the time spent by the launches in moving from the base to the area of operations and created more favorable conditions for their uninterrupted maintenance.

The character of the repair operations conducted was determined by the high intensity of the use of the launches (the launches were on the move up to

65 percent of the time) and by the composition of their weapons (machine guns, mortars, grenade launchers, radios, and radar sets). Repair of the main (diesel) engines of the launches was the primary type of work. In addition, engine mufflers were replaced by more improved devices for cutting down noise, the vibration of the propellers was eliminated, the water tightness of the hulls was increased, the steering gear was improved, etc.

A total of 1,700 diesels, 600 water pumps, 1,000 radio sets, 400 radar sets, 700 mortars and grenade launchers, and 1,500 machine guns were repaired in 1968 at American repair bases in Vietnam. In doing this, the unit replacement method was basically used. This was caused by the shortage of qualified specialist repairmen. Either complete engines or only their worn out parts and assemblies were replaced. The removed engines were repaired in floating workshops by the forces of a specialized brigade (two in 6-10 days). On the whole about six percent of the time the launches stayed in Vietnam was spent on their repair.

The U.S. Navy command sent support vessels (including four floating workshops), which had been equipped beforehand, to South Vietnam for the technical maintenance and repair of ships with small displacement, helicopters and aircraft. In particular, the number of living quarters for launch personnel (up to 15 launches were based at a floating workshop) and of specialists which were included in the crew for repairing engines and radio electronic equipment was increased. It was possible to repair optical instruments, engine nozzles, measuring instruments, and typewriters here. The composition of communications equipment was increased and, therefore, the power of the ship's electric power station was increased by 100 kilowatts. The capability for storing spare parts, including engines was enlarged in the warehouses of the floating workshops.

The first of these floating workshops for repairing assault systems, the ARL 38 "Krishna", arrived in the Gulf of Tonkin area in 1965. The second (the ARL 23 "Satyr" was in the Mekong River area, 85 miles southwest of Saigon. It was sent for repairs to Yokosuka after 16 months of uninterrupted operation. The third (the ARL 30 "Askari") operated in Vietnam from 1967 to 1972. The fourth (the ARL 24 "Sphinx" was operational in the Mekong River delta.

A floating workshop for repairing internal conbustion engines, the ARG4 "Tutuila", and a floating workshop for repairing helicopters and aircraft, the ARVH 1 "Corpus Christi Bay", were also sent to Vietnam.

A dock landing ship for repairing launches and helicopters, the LSD 26 "Tortuga",was in Vietnam from 1966. Various launches were repaired in its well. The personnel of the launches and helicopters undergoing repair were accomodated and fed on it. Various systems were used during the repair of ships with small displacements. Thus, in the forward operational bases, launches were lifted from the water and placed on the deck of a floating workshop or on a special sectional ponton using the vessel's boom (lifting capacity up to 60 tons) and floating cranes.

Four devices for lifting ships--synchronized lifts--were built in the bases for launches with large displacements. A synchronized lift consists of two piers standing side by side on piles and located between them platforms on which is a mobile bogie with a docking set. High speed synchronized electric winches with cables, which are fastened to the platform, and having an identical speed regardless of the size of the load attached to it, are mounted on the piers. After the raising of the platform, the launch can be moved to the shore on the bogies and the synchronized lift can begin to raise the next one.

The first synchronized lift became operational in January 1971 in Danang. Thanks to the availability of four 60-ton synchronized winches, its lifting capacity reached 150 tons. The three other synchronized lifts had a lifting capacity of 300 tons each. The time for raising or lowering a launch was 26 minutes. American specialists point out that ship lifting equipment of this type is simple to operate and cheaper than floating docks.

A tower-less ship lifting dock with a ponton (dimensions-- 8.5 x 27.4 x 1.5 meters) was also used for dry docking launches. It consisted of two pile piers with winches standing side by side with a docking ponton located between them which was a lifting platform (a docking set was mounted on it). Cables, attached to the ponton, eleminated the list of the "ponton-ship" system when coming to the surface. The docking ponton comes to the surface after blowing out the ballast tanks with air, then they take it to the sea-wall, repair the ship and bring another docking ponton between the piers in order to raise the next ship.

Non-autonomous sectional and collapsible small floating docks made of unified steel pontons (dimensions-- 1.52 x 2.13 x 1.52 meters), transported on vehicles and created during the years of the Second World War, were also used for ships with small displacement. With the help of a vehicle crane, the pontons are connected into individual lengths which are lowered into the water by tractors. Then, the lengths are connected to each other into a powerful docking ponton using the tackle gear. The towers are assembled from these pontons. The floating dock comes to the surface after the ballast water is removed from the docking ponton. Its dimensions are from 8.5 x 21.5 to 15.2 x 53.3 meters and its lifting capacity from 100 - 472 tons.

LCM 8 - type, assault landing craft served as very simple docks. The bow tank was adapted as a ballast tank in order to create sufficient trim difference in the bow so that it would be possible to bring a launch into the assault hold. In addition, a winch was mounted on the LCM-8 and rollers -- on the deck of the assault hold which performed the role of a docking well. This provided for dragging a launch into the hold when it touched them with its bottom.



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# METHODS OF COMBATING ANTISHIP MISSILES

Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 4, Apr 79 signed to press 6 Apr 79 pp 59-64

[Article by Engr-Capt 1st Rank V. Tyul'pakov: "Methods for Combating Antiship Missiles"]

[Text] The naval commands of the aggressive NATO bloc have reviewed their opinions on antimissile defense (PRO) during recent years and have taken a number of measures to defend both individual ships and large units from massed strikes by UR [guided missiles] of various types. Judging from foreign press reports, they embrace a wide circle of questions and avenues for improving the organization of the combat control of systems for protecting vessels against attacks from the air, modernizing existing and developing new short range ZURO [antiaircraft guided missile weapons] and antiaircraft artillery systems. Special attention is being devoted to reconnaissance and REB [radio electronic warfare] systems.

The organization of a vessel's antimissile defense includes a series of measures. In this respect, primary importance is being attached to automating the processes for collecting and processing information, making decisions, and controlling PRO forces and systems. Foreign military naval specialists define the effectiveness of the combat control of ship and large unit PRO systems as the ability of PRO systems to react quickly to a threat under the conditions of a rapidly changing tactical situation and massed strikes by antiship missiles (PKR). This capability is evaluated in accordance with the "reaction time" criterion (the period from the time a target is detected to the opening of fire).

At the present time, a number of organizational and technical steps are being taken to decrease it. For example, a fundamentally new type of combat information center (BIP)--in which the following technical systems are combined on a functional and territorial basis: those for collecting and processing information, for depicting the air, surface and underwater situation, and for controlling weapons and the ship--has been developed for Virginia-class URO [guided missile] cruisers. The cruiser's BIP optimizes air defense and allows a coordinated solution of all the fundamental tactical tasks in preparing for, and conducting fire both autonomously and as part of a large unit.

In the U.S. Navy, work on improving the PRO defense of ships and large units has been conducted since 1972 in accordance with various designs under the overall title of ASMD (Anti-Ship Missile Defense). This takes into consideration deficiencies in earlier developments and changes in the ship-building program and also reflects the views on the PRO problem which had been developed by that time. In accordance with the designs, it is planned in the first place to develop combination PRO systems, which combine different firing systems, jam-free radars for the detection of low flying PKR, and radar and electronic-optical surveillance and jamming systems, for future Spruance-class destroyers and Virginia-class guided missile nuclear powered cruisers.

In the opinion of experts in the naval forces of the NATO bloc countries short range ZURO still do not answer the requirements for protecting ships against low flying PKR. Their improvement is being carried out abroad by sharply increasing their target detection and destruction probability, decreasing reaction time to 2-3 seconds, and increasing the fire capability of these systems.

Thus, U.S. and French naval specialists are developing together a new ZURO systems for repulsing attacks by PKR flying at very low altitudes. Based on its design, it includes equipment to warn about the radar illumination of the ship, means for detecting targets, a control system, multi-round PU [launch mounts] consisting of 20 or more ZUR [surface-to-air guided missiles] and a two-mode homing warhead.

Evaluation tests of the "Seawolf" ZURO system are taking place in the British navy (four versions have been developed). One version ("Seawolf") is the basic and all-weather one. It is planned to arm vessels having large displacements with it. The three other ones: "Seawolf/Psi", "Seawolf/Delta" and "Seawolf/Omega", have been simplified and will be mounted on ships having a displacement of 400-2500 tons.

Four versions of a self-defense missile system on a self-contained light platform have been created on the basis of the army "Blowpipe" SAM. It is planned to mount these platforms on vessels of all classes where there is a free spot and sufficient deck strength.

The "Shield" ZURO system is being developed for the self-defense of vessels with small and large displacements. It is proposed to make a SAM based on the air-to-air "SRAAM"-class missile (length-- 2.73 meters, diameter--17 centimeters) with an IR [infrared] homing warhead having increased sensitivity and capable of searching for and locking on targets at any angle of approach. The launch mount will have five fiberglass containers located in a star-shaped pattern. The missile's high maneuverability permits making a PU [launch mount] without a horizontal guidance wire.

A new SAM--"Sea Flash"--based on the all-weather air-to-air medium range "Sky Flash" is being designed to arm high speed ships. In the opinion of the developers, it will replace the "Sea Sparrow" SAM or become the basis for its improvement.

The U.S. Navy plans to create a PRO CIWS (Close-In Weapon System) which will contain "Vulcan"-type antiaircraft artillery mounts, the "Sea Chapparal" ZURO system and a combination "Hybrid" PU for "Sidewinder", "Red Eye', "Stinger", and "HARM" guided missiles. It is planned to use these missiles based on the range a PKR is located from a ship, its altitude, flight speed, vulnerability, and the presence of jamming.

In order to increase the probability of detecting low flying PKR, ships are being equipped: with radar and electronic-optical surveillance systems; radars that are protected against interference jamming arising from the re-radiation of the signal, reflected from the target, by the sea's surface; and helicopters for below-the-horizon detection of PKR and target designation. It is planned to use "Lynx" helicopters and "Lamps" systems as aerial detection systems in the U.S. and British navies.

The reaction time of ZURO systems is being decreased by automating the process for locking on aerial targets, bringing up missiles and reloading PU and by using containerized PU with a vertical launch. For example, based on the joint design of seven NATO countries a simplified "Sea Sparrow" ZURO system having a vertical launching of the missile has been developed and is undergoing tests. An eight-container launch mount and an AIM-7M missile with a radar homing warhead are used in it. A ZURO system, with which they plan to arm air cushion and hydrofoil ships, has been developed in the U.S. Navy. In the FRG navy, they have developed the "Zesta" SAM (range up to 16 kilometers) and a PU for it. It is thought that vertical launching excludes the limitations caused by the presence of superstructures and "dead zones"; permits the weight, dimensions and cost of PU to be decreased; and sharply increases the firing capabilities of ZURO systems since SAM's can be launched in any sequence at several targets simultaneously or in salvo.

Foreign military specialists are trying to increase the probability of antiaircraft missile weapons destroying PKR by improving SAM guidance systems; equipping them with multi-mode homing heads, including those with radar and electronic-optical systems; mounting charges of great destructive force in the missiles; and creating antiaircraft missile barrier fire complexes.

Thus, a warhead, containing a considerable amount of metal balls which are scattered by an explosion and which ensure a high degree of probability that the target will be destroyed, has been developed for the SAM's of the French "Flash" ZRK [antiaircraft missile complex]. French navy specialists also think that it is advisable to arm a ship with rocket mounts, which will ensure a high degree of probability that the target will be destroyed,--in addition to ZURO systems--in order to effectively beat off massed attacks by PKR flying at low altitudes.

At the present time, the naval Katyul' system, which consists of a 64-round PU, the Zhavelo NUR [free-flight rocket], an automatic control system for launching the rockets, EVM [electronic computer] and a surveillance and tracking radar, is being developed based on the army "Zhavelo" antiaircraft missile complex. The PU permits salvo firing to be conducted with an interval of 2-4 seconds. The French naval command thinks that this system will effectively supplement the naval version of the "Crotale" ZRK in repulsing low flying PKR.

Antiaircraft artillery (AAA) is regarded by western specialists as an effective supplement for short range ZURO systems and in a number of cases as the main firing system of small displacement ships in repulsing PKR. It is thought the small probability of destroying PKR with one small caliber artillery shell is compensated for by the high rate of fire which creates a curtain of shrapnel and by the considerable amount of ammunition ready for immediate action. About ten antiaircraft artillery systems with a caliber from 20-76 mm had been developed in the naval forces of the capitalist countries by the end of the Sixties and beginning of the Seventies.

During recent years, Western specialists have been devoting considerable attention to AAA with a caliber of 20-40 mm which--in their opinion--permits the creation of small antiaircraft artillery complexes having great firing capabilities and which answer the requirements of the battle against PKR. As the foreign press reports, they have increased accuracy of fire by using more improved systems for controlling fire and possess high effectiveness in destroying high speed, low flying targets. As a result of automating the basic processes in controlling and conducting fire, reaction time has been sharply decreased.

During recent years, standard and simplified versions of the 20-mm naval six-barrel "Vulcan" artillery mount, having a high rate of fire which can be 1000 and 3000 rounds per minute, have been developed and introduced into the armament of the U.S. Navy. The supply of quick firing fixed rounds in the magazine is 1000 rounds (for the standard mount) and 500 (for the simplified one). The guns are hydraulically stabilized. The standard mount has an electronic-optical sight for firing during the day and night. Ships are also equipped with the short range "Vulcan-Phalanx" antiaircraft artillery systems which includes the 20-mm six-barrel "Vulcan" gun (rate of fire--3000 rounds per minute) and the "Phalanx" fire control system.

The "Meroka" naval artillery system which consists of two 20-mm six-barrel mounts (rate of fire--2700-3600 rounds per minute, range--2000 meters) has been created in the Spanish navy to destroy aircraft and PKR.

REB systems. Until the Seventies no unified views had been developed in the naval forces of NATO countries on radio electronic jamming for defending ships against PKR among foreign naval specialists, there were those who advocated combatting PKR only with active systems, maintaining that it was impossible to create the necessary jamming equipment in view of the absence of the necessary information about missile guidance systems and the best ways to neutralize them. The effectiveness of using jamming to beat off PKR attacks also came into doubt because of the large area of a ship's effective reflecting surface and the possible gaps in the radiation pattern of the jamming stations.

Other specialists maintained that jamming systems could be sufficiently effective if they were used in combination with equipment for radar surveillance and for the analysis of radiation since methods for neutralizing missile guidance systems could be developed on the basis of research into their immunity to jamming.

The experience from the Arab-Israeli war and the war in Vietnam convinced the naval commands of NATO countries of the advisability of using jamming to protect ships against PKR. Military naval specialists emphasize that a ship's PRO system can be effective only in the event of the combined use of surveillance systems, active and passive jamming, and weapons.

Beginning with the end of the Sixties REB systems, based on the requirements for defending ships against antiship missiles, were developed in the U.S. Navy and then in the naval forces of the other NATO countries. In the U.S. Navy, they first proposed the creation of a single unified active jamming system of modular construction in order to use it in different groupings on newly constructed ships. In accordance with the "Shortstop" program, the AN/SLQ-27 active jamming set was designed which searches for radiation from PKR guidance systems, identifies it, and, depending on the type of missile guidance system, automatically creates non-selective defensive jamming, simulation jamming or noise jamming. However, in the opinion of foreign military specialists, the experience of creating a universal REB system was unsuccessful: The set turned out to be complicated and expensive, wasn't highly reliable, and was large and heavy. Because of this, the U.S. Navy command declined to produce it.

At the same time, within the limits of this program a combination jamming system (designated AN/SLQ-29) was developed for Spruance-class destroyers on the basis of the AN/WLR-8 surveillance radar and the AN/SLQ-17 jamming transmitter which are in the armament of submarines.

According to the new conception of the U.S. Navy, REB systems must guarantee the protection of ships against various types of attack systems and supplement each other in solving this task.

In 1974, the U.S. Navy--based on these requirements--began to develop a new REB system in accordance with the DPEWS (Design-to-Price Electronic Warfare Systems) program, according to which it is proposed to create an active jamming system of modular construction for guided missile cruisers, destroyers, large assault ships, and transport vessels. The AN/SLQ-31 and-32 sets were developed on the basis of two competing designs. It is planned to release the latter in three versions for ships of various classes and "Lamps" system helicopters.

Passive jamming in the form of chaff clouds and IR traps, which attract missiles to themselves, is one of the effective protection methods against PKR having radar and IR guidance systems during the final stage of their flight path. In the opinion of foreign specialists, they must be thrown out using NUR at various firing ranges at the moment a PKR is detected on the radar horizon and again as it approaches the ship.

During recent years, several passive jamming systems have been created in NATO countries and a portion of them have become part of the ships' armament. They include launch mounts having a load of shells or missiles, equipped with antiradar chaff or a compound for creating false IR targets. Normally, fire control is automatic and based on data from the surveillance radar. Two-three such PU are usually mounted on one ship.

In the U.S. Navy, the RBOC (Rapid Bloom Off-Board Countermeasures) systems for creating false targets has been developed based on the TEWDS (Tactical Electronic Warfare Deception System). It includes several types of radar chaff and IR traps as well as launch mounts for firing NUR at different ranges. The "Protin" system with a grenade-type PU and the "Korvus" system for launching NUR are used in the British navy. The "Dagay" passive jamming system, which permits putting out at the same time up to ten IR traps, has been developed in the French navy.

Passive jamming systems have been created in NATO countries not only according to national programs but also within the limits of this bloc. An international consortium of five countries (the United States, Great Britain, The FRG, Denmark, and Norway) has been formed to develop a system for creating false targets. It has been designated "Sea Gnat."

These are the basic directions in the development of systems to combat antiship missiles in the naval forces of the NATO bloc countries.



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POSSIBLE CHARACTER OF MEDITERRANEAN OPERATIONS

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[Article by Capt 3d Rank V. Khomenskiy: "The Possible Nature of Military Operations in the Mediterranean Sea"]

[Text] The military and political leadership of NATO considers the Mediterranean Sea to be one of the springboards for possible aggressive operations directly against the USSR and other countries of the socialist commonwealth and for carrying out its expansionist goals in the Near East and Eastern Mediterranean. It is the main link in the Southern European theater of military operations and has an important strategic significance which is determined by geographic, military and economic factors. Air and sea lines of communications of world-wide importance, linking the Arab countries which are rich in oil (70 percent of the detected reserves of the capitalist world) with Europe and America, pass through it. Every day, more than 3,000 freighters are in the Mediterranean basin and a third of them are tankers and other oil carrying ships. In the opinion of foreign military naval specialists, the volume of sea transport in the theater of operations will increase sharply with the beginning of military operations. This will be dictated by the need to transport troops, military equipment and all types of supplies within the boundaries of this or neighboring theaters.

The considerable length of the seacoast with its great number of large military, industrial and administrative centers, naval bases, and ports creates, as the Western press testifies, favorable conditions for basing and deploying naval forces including the 6th U.S. Fleet. In addition, American nuclear missile submarines, capable of inflicting nuclear strikes on the territory of the Soviet Union and other socialist states, are continuously on patrol in the waters of the Mediterranean Sea.

Taking these factors into consideration, NATO's leadership makes the success of military operations in the Southern European theater of military operations directly and primarily dependent on naval forces. Judging from foreign press reports, the following major tasks will be assigned to the naval forces which have nuclear weapons and a large arsenal of conventional destruction systems in their armament: inflicting nuclear strikes on operational and strategic objectives on the territory of the enemy, gaining sea superiority, supporting ground forces when they are conducting combat operations on maritime avenues, and defending sea lines of communications.

The NATO command considers that military operations on the sea will acquire a broad scope, be conducted on the water, under the water and in the air using both conventional and tactical nuclear weapons, and will have an offensive or defensive character. The naval forces of the NATO Mediterranean countries (Italy, Greece and Turkey) and the naval forces of the United States and Great Britain, which are based here, will take part in them. The foreign press does not exclude the possibility that the naval forces of France will also take part in military operations in the Mediterranean Sea as part of NATO's naval forces. In addition, NATO's military and political leadership assumes that Spain, which maintains close political, economic and military relations with the countries of the bloc and is tied to the United States by bilateral treaties, can also come forward on its side.

By the end of 1978, the naval forces of the NATO member nations on the Mediterranean Sea and the naval forces of the United States and Great Britain located here numbered about 500 of the main types of fighting ships and boats and 400 carrier and shore-based patrol aircraft (including more than 40 ships, up to six nuclear missile submarines and 160-180 aircraft in the American fleet). The forces, which have been mentioned, are included in the composition of two main commands--NATO naval strike forces in the Southern European theater of operations and NATO allied forces in the theater. The nuclear missile submarines of the U.S. Navy remain under national control; however, they will be used in the interests of the bloc.

The American nuclear missile submarines (equipped with Polaris A3 and Poseidon missiles) which are part of the U.S. strategic offensive forces are the primary means for inflicting nuclear strikes against large military objectives and administrative and industrial centers both in coastal regions and in the rear areas of its territory. When commonting on the great striking power of PLARB, NATO specialists emphasize at the same time that it can only influence to a significant degree the course of military operations during the initial stage of a war and will not be a deciding factor in its outcome.

The United States and NATO command element regard the 6th Fleet's carrier large unit, which is constantly deployed in the waters of the Mediterranean Sea, as an offensive nuclear force reserve. With the announcement of a simple military alert, it becomes subordinate to the commander-in-chief of NATO's Allied Forces Southern Europe and is used as part of the bloc's naval strike forces.

Judging from foreign press reports, the carrier groups of this large unit will operate separately in its central and eastern portions. Western military experts suppose that carrier-based aviation, which has a considerable radius of operation (up to 2000 kilometers) will inflict strikes by nuclear and conventional weapons on objectives in the depths of the enemy's defenses in order to blow up his military economic potential, destroy troop control and their rear area support, and demoralize the population. Th :efore, despite the fact that during recent years the main mission of aircraft carriers has been considered to be the gaining of sea superiority, their participation in the general nuclear offensive--which was placed on them after the Second World War--is regularly practiced during command post exercises of the allied and national naval forces.

Gaining superiority on the sea, in the opinion of foreign military specialists, is the primary condition for the successful achievement of objectives in a war at sea. Taking the large spatial range of the theater into consideration, they point out that one can talk about its establishment only in limited areas and for the time required for naval forces to carry out specific operations.

Gaining sea superiority presupposes first of all a struggle against the submarines and ship groupings of the enemy navy on the open sea and blockade operations in the areas of the Black Sea and Gibraltar straits in order to maintain continuous control over them.

The battle against submarines envisages the destruction of submarines where they are based, in areas of combat employment and on deployment routes by inflicting strikes on them with the forces of the fleet and other types of armed forces. One of the measures for combating submarines is the organization of the ASW defense for large units of fighting ships and convoys.

NATO specialists think that the inflicting of strikes on submarines in their bases cannot completely eliminate the underwater threat because part of the submarines are continuously at sea. Therefore, it is planned that the main effort be directed to their destruction on deployment routes and directly in the areas of military operations. For these purposes, the use of all ASW forces, available in the theater of operations (nuclear and diesel submarines, ASW ships, shore-based patrol and carrier-based ASW aircraft and helicopters) is provided for. The NATO command emphasizes in this regard that the battle against submarines must be centrally conducted throughout the Mediterranean from the Black Sea to the Gibraltar straits.

One of the avenues in the struggle against submarines is considered to be the organization of their tracking (passive and active) during peacetime. It has been reported in the foreign press that networks of the fixed and passive long range sonar surveillance system," Bronco"-- "Barrier," which have been placed along the coasts of Spain, Italy and Turkey, are operating in the Mediterranean Sea. The initial detection, classifications and tracking of submarines is accomplished with the help of this sytem's sonar equipment.

A special place in "antisubmarin e warfare" is allotted to shore-based patrol aviation which possesses high mobility, maneuverability and considerable destructive potential. It will be involved in the search for enemy submarines by patrolling in assigned areas and the ASW defenses of large units of surface vessels and convoys and by conducting reconnaissance. Based on foreign press data, up to 80 shore-based patrol and reconnaissance aircraft which operate from airbases in Sigonella (Island of Sicily), Fontanarossa (Italy), Suda (Crete), Rota (Spain), and Bandirma (Turkey) are in the fleets of the NATO countries in the Mediterranean Sea. They are capable of solving tasks both independently and in coordination with other ASW forces and systems, including fixed passive long range sonar surveillance systems.

In the opinion of foreign military naval specialists, submarines, which have already been placed during peacetime under the command of the NATO allied submarine forces in the Mediterranean Sea, must play an important role in the solution of ASW tasks. Nuclear and diesel torpedo submarines from the naval forces of the United States, Great Britain, Italy, Greece and Turkey are included in it. It is planned to use them both on the approaches to the straits and in separate areas using the position-maneuvering method.

It is planned to enlist submarines, ships and the carrier-based aviation of NATO's naval striking forces in the battle against ship groupings of the enemy fleet. The general principle for using carrier-based aviation when operating against group surface targets provides for the formation of strike and support groups. The former include attack aircraft and fighters and the latter--aircraft for deception measures, suppression of air defense and REB [radio and electronic warfare] systems, observation, and other purposes. As the foreign press reports, about 20 aircraft, including up to ten attack aircraft, are needed for the battle against a grouping of surface ships (consisting of three-four ships), and five (three attack aircraft and two fighters) for the destruction of a single vessel.

It is thought that the active operations of carrier-based strike forces against surface vessels will be conducted in the main for three-five days.

Based on announcements of the NATO command, the maintenance of continuous control over the areas of the Black Sea and Gibraltar straits is one of the decisive factors in the successful conduct of military operations in the Mediterranean Sea. Judging from foreign press materials, blockade operations are being energetically practiced even during peacetime in the area of these straits during numerous exercises of NATO's naval forces ("Open Gate", "Locked Gate", "Dawn Patrol," etc.).

In the opinion of foreign specialists, the fleets of Greece and Turkey will be the primary covering detachment against the breakthrough of groupings of the probable enemy from the Black Sea into the Mediterranean. As the Western press reports, these states will deploy more than 50 percent of the naval force combat component directly in the area of the Black Sea straits, that is, more than 100 fighting ships (including up to ten submarines) and 20 ASW aircraft and helicopters. It is provided that they will be reinforced, when necessary, with ships from NATO's naval striking forces in the Southern Europe theater of operations.

Provisions are made for conducting the blockade of the Straits of Gibraltar primarily with the naval forces of Portugal, Great Britain and the United States. The NATO command does not exclude the possibility of also using the fleets of Spain and France in this area.

Based on the testimony of foreign specialists, aviation which solves a broad circle of tasks: from reconnaissance of the enemy to the inflicting of strikes on ship groupings which have broken through the straits, will have major importance during the blockade of the straits. In their opinion, it can be in a number of cases the only force capable of inflicting strikes on the enemy on the far approaches to the straits, in the Black Sea in particular. Naval aviation coordinates closely with tactical aviation when organizing blockade operations.

Tasks of destroying enemy surface vessels and submarines, conducting reconnaissance, ensuring the guidance of the other forces of the fleet, and laying mine fields are placed on submarines deployed on the approaches to straits. Based on experiences from exercises, submarines normally use the position-maneuvering method.

Significant importance in the defense of straits is attached to missile and torpedo boats. According to material in the Jane's reference book, the naval forces of Greece and Turkey have 17 missile and 32 torpedo boats which it is planned to use both independently as part of attack groups (five-six boats) and jointly with the other forces of the fleet. In this respect, the organization of joint actions supposes the use of mass attack tactics from various directions. This can lead to fragmentation of the enemy's efforts to repulse a missile attack and quarantee a certain portion of the boats getting through to the target.

When conducting blockade operations in the areas of the straits, the NATO command plans to make active use of mines and boom and net barriers (in the Black Sea straits). When making a decision to lay mines, the fact that this can deprive friendly forces of operational flexibility and the opportunity of reacting to a change in the situation in a timely fashion, is taken into consideration. Aviation, submarines and surface vessels of practically all classes will be involved in mine laying. Based on Jane's reference book, seven mine laying ships and seven boom and net tenders are in the Turkish fleet.

For the sake of conducting blockade operations it is planned to use on a broad scale coastal artillery which is capable of destroying ships on the approaches to the straits and directly in the area of the straits.

As the foreign press emphasizes, the successful solution of tasks in blockading the Gibraltar and Black Sea straits can be achieved only on condition that the heterogeneous forces of the fleet are used, other types of armed forces are used and their close coordination is organized. The conduct of blockade operations will have a protracted nature and require, in the opinion of Western specialists, the carrying out of a series of measures directed at ensuring the operations of heterogeneous forces: reconnaissance, camouflage, the use of REB systems, control, communications, the organization of all types of defenses, and logistics support.

In their estimation, the American carrier large unit, located in NATO's naval strike forces in the Mediterranean Sea which are the most combat ready and capable operational formations of the bloc's armed forces in the Southern European theater of operations, must play an important role in gaining sea superiority.

The gaining and maintenance of sea superiority is an important condition for the successful carrying out of the naval forces' mission of supporting ground forces operating on maritime avenues. Its performance assumes the providing of fire support to ground forces and naval assault forces by aviation and ships, the landing of assault forces in the enemy rear or on his flank, the transport of troops and their supplies by sea, and the disruption of the enemy's sea transport.

Based on Western press reports, air support envisages the providing of deep (long range) and direct support and the provision of friendly air defense. When providing deep support, strikes are inflicted on enemy airfields, depots and troop groupings, located to a depth of 5-50 kilometers from the front line; the area of military operations is isolated.

Direct air support, to which the command element of NATO's naval forces attaches special importance, is organized for ground forces or assault forces in close coordination with carrier and tactical aviation. Its zone normally does not exceed five kilometers. When providing support, aviation inflicts strikes on troops in combat formations, missile launch areas, artillery firing positions, command points, etc.

Based on the experience of exercises which have been conducted, carrier aviation is used to support ground forces only after the tasks facing it in gaining sea superiority have been solved. In doing this, carrier multipurpose groups operate, as a rule, in dispersed combat formations, each in its own maneuvering area. In order to increase the depth of carrier aviation combat operations, these areas--if the situation permits--can be drawn nearer to the coast (up to 100 kilometers), especially during periods of launching and landing aircraft. When providing support using conventional destruction systems, carrier-based aircraft operate in separate groups of 4-20 machines and when inflicting massed strikes on the most important objectives--in groups up to 40 machines.

In the opinion of foreign military specialists, naval fire support (gun and missile) will be directed at the neutralization and destruction of enemy objectives and men on the shore.

Regarding naval assault operations as a special form of offensive combat operations, NATO's military leadership thinks that they will be widely used in all types of warfare in the Southern European Theater of operations.

The fact that there are constantly combat ready groupings of naval assault forces, including assault vessels and marine subunits, in the American fleets even during peacetime testifies to their increased importance. The American marines in the Southern European theater of operations are represented by a reinforced battalion (up to 1800 men) deployed on ships of the 6th Fleet.

Along with the numerous combined exercises of the "Dawn Patrol" and "Display of Determination" type during which the landing of assault forces is one of the major elements, up to ten assault exercises of various scales are annually conducted by national naval forces.

The NATO command makes the successful conduct of a war in the theater directly dependent on the reliable functioning of sea lines of communications. The large length of communications lines in the Mediterranean Sea evokes the need to have a considerable amount of heterogeneous forces and means for their defense.

Taking this factor and the increased capabilities of modern submarines into consideration, NATO's military leadership constantly practices during peacetime problems on defending sea lines of communications in the Mediterranean Sea. The protection of sea lines of communications, the escorting of convoys, and the battle against enemy submarines were some of the main tasks during such exercises as "Dawn Patrol - 78", "Open Gate-78", "Display of Determination-78" and others.

The defense of sea lines of communications in the Mediterranean is organized on a zonal principle in accordance with the organizational structure of NATO's Allied Naval Forces Southern Europe and the cutting up of operational areas in the bloc system. The common direction and planning of measures to defend communications on the Mediterranean Sea are placed on the commander of NATO naval formations in the theater and are implemented through the appropriate commanders of NATO naval formations in the following regions: Gibraltar (headquarters--Gibraltar Naval Base, zone of responsibility of the naval forces of the United States and Great Britain), Western and Central (headquarters--Naples and Santa Rosa, zone of responsibility of the Italian naval forces), Eastern (headquarters--Athens, zone of responsibility of the Greek naval forces), Northeastern (headquarters--Ankara, zone of responsibility of the Turkish naval forces), Southeastern (headquarters on Malta, zone of responsibility of U.S., British and Turkish naval forces).

Judging from foreign press reports, an important step in organizing the defense of sea-lines of communications will be the military and naval control of navigation. Its organs must solve the tasks of forming convoys, organizing their passage, determining movement routes, and other questions connected with guaranteeing the security of merchant shipping. In doing this, it is thought that the convoy system will be one of the major forms of guaranteeing military and commercial transport. During the operational and combat training of NATO's naval formations in the Southern European theater of operations, questions on the staged escorting of convoys, during which all forms of their defense are placed on the naval forces of the country in whose zone of responsibility they are located, are practiced during peacetime.

The protection of convoys is provided by immediate, close in and outer screening ships, submarines and ASW aircraft and helicopters (shore-based and carrier-based). It is envisaged that vessels will travel behind minesweepers in places very suitable from a geographical regard for the enemy to lay minefields.

A broad network of naval bases and stationing points has been created for the deployment and support of the combat activity of NATO's naval formations in the theater. The largest of these are: Rota, Gibraltar, Naples, Taranto. La Spezia, Augusta, Suda, Messina, Izmir, and Iskanderun. The naval bases at Naples, Augusta, Cagliari, Brindisi, Leghorn and Palermo are regularly used by ships of the 6th Fleet.

In the opinion of foreign military specialists, the network of naval bases which has been created is capable of providing for the dispersed basing and movement of the forces of the fleets of national, English and American naval forces in the Mediterranean. However, as they consider, under modern conditions shore bases alone cannot ensure the conduct of military operations by naval forces to the necessary degree. Therefore, NATO's naval command is devoting considerable attention to the creation of a mobile basing system which brings rear area support points as closely as possible to the probable areas of military operations.

Judging from foreign press material, several views of the NATO command element on the principles concerning the operational and strategic employment of the fleet's forces are being reviewed and firmed up. New concepts in the employment of naval forces in the Southern European theater of operations are constantly being checked out and developed during intensively conducted operational and combat training.



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SOVIET COMMENTS ON NATO SONAR CAPABILITIES

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[Article by Engineer-Captain 1st Rank (Res) A. Prostakov, Candidate of Military Sciences, Docent: "Sonar Equipment on NATO Naval Antisubmarine Warfare Ships"]

[Text] In their militaristic preparations for war, and for what is referred to as "antisubmarine warfare" in particular, the naval commands of the aggressive NATO bloc member countries are assigning a substantial role to ASW ships provided with the latest sonar equipment. Approximately 500 such vessels are to be counted in the navies of the North Atlantic bloc countries. Work is currently under way on the improvement of existing sonar sets (GAS) and the development of new ones.

According to reports by foreign specialists, the U.S. Navy's most advanced sonar system is the AN/SQS-26, work on the development of which was begun in 1958. It began to appear on ships in the early 1960's, but it subsequently underwent modification for the purpose of eliminating structural deficiencies and enhancing reliability. Systems which have already been installed in ships are also undergoing modernization.

The AN/SQS-26 sonar has a panoramic surveillance capability and may be operated in both active (sonar) and passive (sound listening and detection) modes. Depending on the hydrological conditions in the area, this sonar operates in the surface sound duct; in distant acoustical illumination zones appearing on the surface some 50 km from the sonar set; or in shallow waters with multiple reflections from the bottom to "illuminate" the acoustical shadow zone. Special units are utilized to classify a detected target. The sonar tracks several detected targets simultaneously and transmits target data to the Mk 114 antisubmarine-weapon fire control system. It can also provide underwater acoustical communications.

The set consists of approximately 30 racks, consoles and individual pieces of equipment (Figure 1). A large (4.8 m diameter) acoustical antenna is mounted in a bulb-shaped bow housing.

This sonar set is fitted in "Truxton" type and "California" class nuclear-powered guided missile cruisers, "Belknap" class guided missile cuisers, "Brooke" and "Knox" class guided missile frigates and "Garcia" and "Bronstein" class frigates (approximately 70 vessels in all).

Advances in the field of radio electronics over the course of the past decade, for example the development and introduction of integrated circuits into the system, the conversion to digital signal processing and so forth, have made it possible to modernize the AN/SQS-26 sonar. The new set (designated the AN/SQS-53) incorporates several pieces of apparatus from the former, the acoustical antenna in particular. According to foreign press reports, its effective range has remained virtually unchanged. The sonar is connected with the ship's Mk 116 antisubmarine-weapon fire control system (Figure 2). Information received from the sonar set is processed using an AN/UYK-7 digital computer, displayed on a special plotting board and alphanumeric and graphic data display unit located on the ship's pilot bridge and also transmitted to the central panel of the antisubmarine weapon fire control system. The data acquired are thus used to track submarines which have been detected, for selecting the ASW weapon to be employed (ASROC antisubmarine guided missile, depth charge, torpedo), calculating and correcting fire data and for issuing firing commands.

The AN/SQS-53 may also be employed in the mode for countermeasures against weapons with acoustical guidance systems. It is being fitted in the "Virginia" class nuclear-powered guided missile cruisers and "Spruance" class destroyers.

The AN/SQS-23 sonar, which was developed in the late 1950's, is the one most widely employed in the U.S. Navy. In its tactical-technical specifications it is inferior to that discussed above. The set may be operated in the active (its effective range not exceeding 18 km) and passive modes. It provides initial data for Mk 114 antisubmarine weapon fire control system, which processes data for the ASROC PLURO /antisubmarine guided missile/ system, depth charges and torpedoes.

The AN/SQS-23 is fitted in the American "John F. Kennedy" and "America" aircraft carriers, the "Long Beach" nuclear-powered guided missile cruiser, "Albany" class guided missile cruisers, all destroyer classes except the "Spruance" (roughly 120 vessels), as well as on the Italian naval vessels the cruiser "Vittorio Veneto", "Andrea Doria" class guided missile cruisers and "Impavido" class destroyers; the Turkish destroyer "Adatepe"; and

"Lütjens" class destroyers of the FRG /Federal Republic of Germany/. It has been repeatedly modernized during the course of its operational life.

The AN/SQS-56 sonar, all electronic components of which have been converted to integrated circuits, was developed in 1975 on the basis of the AN/SQS-23. This has made it possible to reduce the size and weight of the equipment substantially and, according to foreign specialists, to enhance considerably its reliability. The set is connected with the AN/UYK-16 general-purpose, shipwide computer, which accomplishes hydroacoustic signal processing by means of the application of standard programs. The use of the computer has simplified the work of the sonar operator and made it possible to reduce his required skill level. As a result, according to foreign press reports, an operator may operate the set functioning in any of its modes: active or passive panoramic surveillance, simultaneously tracking several submarines, detecting enemy torpedoes. All acquired data is displayed on a display screen in alphanumeric form.

The AN/SQS-56 sonar is currently fitted in "Oliver H. Perry" class guided missile frigates.

In an attempt to expand their market for the sale of weapons and military equipment, American monopolies have developed an export version of the last-named sonar, which has been designated the DE 1160B. According to foreign press reports, several NATO-bloc countries have already ordered the new sonar and its modifications. The Italian guided missile frigate "Maestrale" /transliterated/, for example, is to be fitted with the DE1164 sonar, which is a combination of the DE1160B sonar with its transducer array housed in a bulb-shaped bow dome and a sonar with a variable-depth transducer array mounted in a ship-towed body. Both sonars may be operated either in combination or individually. In the view of foreign experts, this capability contributes to enhancing the effectiveness of surveillance under adverse hydrological conditions, at depths with sudden changes in temperature for example, or in shallow areas with high levels of reverberation interference.

U. S. Navy specialists are devoting a great deal of attention to the development of sonars with a passive-mode capability. The pages of the foreign periodical press are calling attention to the advisability of employing only active underwater surveillance systems (echo-ranging mode), but this mode suffers from a number of serious deficiencies. Its main shortcoming consists in the fact that the signals emitted by the sonar travel for great distances in the submarine medium, and a submarine may detect the sonar-carrying vessel much sooner than the target itself may be detected. This allows the submarine to surprise attack the ship while remaining beyond the effective range of the latter's sonar. It is therefore recommended that a sonar be operated in the echo-ranging mode only immediately prior to the employment of a weapon and subject to the condition that at that point the submarine be within the sonar's effective operational range.

The U.S. has developed within the last few years the AN/SQR-18 and AN/SQR-19 echo-ranging sonars, which differ essentially from previously developed systems in their long-range acoustical antennas (towed transducer arrays in American terminology). These arrays are in the form of a cable (several tens of millimeters in diameter and up to several hundred meters long). According to information in the Jane's reference, these sonars will be fitted in "Oliver H. Perry" class guided missile frigates and DDG47 type destroyers. The press has also reported the placing of orders for this sonar for the purpose of fitting it into "Knox" class frigates in the course of their modernization. On the basis of foreign press reports it is to be assumed that the number of these sonars will reach 150.

The U.S. Navy is employing conventional sonars with variable-depth transducer arrays on a very limited basis. At the present time, for example, the AN/SQS-35-type sonar has been fitted in only 35 of the 46 "Knox" class frigates. It is not currently proposed to fit these sonars in the "Spruance" class destroyers, in which for them a special place had originally been reserved.

Sonar systems on ships of the British navy are less standardized. One of those in most widespread use is the Type 181 medium-range (up to 4 km) sonar. It is being fitted in "Invincible" class ASW cruisers now under construction, "County" class and the "Bristol" cruisers, "Sheffield" type destroyers and "Amazon" and "Leander" class frigates.

Developed in the 1970's on the basis of the Type 184 sonar is the GI-750 system, which can be operated in both active and passive modes and with its panoramic surveillance capability provide automatic simultaneous tracking of two targets, detect torpedo noise and give sounded and illuminated warning signals. This sonar employs two operational frequencies. Linear frequency modulation of the emitted pulses improves its signal-echo detection capability under heavy reverberation-interference conditions. The use of integrated circuits makes the system sufficiently compact and light in weight. The sonar transmits its data in digital form to the computer for the antisubmarine-weapon fire control system.

Also being fitted in most of the ships referred to above is the Type 162M sonar, whose operation is based on the side-looking principle. It serves to classify underwater objects on the basis of their acoustical shadows.

Type 199 sonars with variable-depth transducer arrays (up to 8 km in effective range), which went into service as long ago as 1962, are also being fitted in "Leander" and "Tribal" class frigates. Remaining English frigates ("Salisbury," "Leopard," and "Blackwood" classes) are equipped with Type 170 and 174 sonars, which were fitted in the late 1950's.

Widely employed in the Canadian navy is the domestically manufactured AN/SQS-505 medium-range sonar (23 units in all). This system provides panoramic surveillance in both active and passive modes and automatic computer-aided target tracking, which makes possible single-operator control. The system includes a special unit designed to classify targets on the basis of their signal echo characteristics. The cylindrical transducer beneath the keel of the ship in a retractable dome. Some models of the AN/SQS-505 sonar may also be equipped with a variable-depth transducer array mounted within a towed body.

This sonar is fitted in Canadian "Iroquois" class destroyers and "Restigouche" (with towed body in some) and "Annapolis" class frigates, as well as in the Dutch "Kortenaer" /transliterated/ guided missile frigates and Belgian "Vilingen" /transliterated/ class frigates. The Netherlands and Belgium each have purchased four sonars of this type.

In 1972 Canada developed the new HS-1000 sonar (up to 16 km in effective range) designed for small naval ASW vessels. The electronics package (contained within a single cabinet) weighs a total of 450 kg. The sonar operates in both active and passive modes, in the first instance employing pulses or continuous signal emissions. The second operational mode makes it possible to detect targets under heavy reverberation-interference conditions. The sonar may be employed in combination with any existing ASW weapon system and fitted in vessels with a displacement of more than 100 tons.

The French navy, which employs only domestically manufactured sonars, has developed a standardized system of sonar equipment for its ASW vessels: "Suffren," "Georges Leygues," and "Tourville" class guided missile destroyers and the destroyers "La Galissonniere" and "Aconit" are fitted with the DUBV-23 and -43 sonars (Figure 3). Sonar system components on vessels of earlier construction do not display the same uniformity: "Dupetit Thouars" and "Duperre" type guided missile destroyers and "Le Corse" class frigates are equipped with the DUBA-1, DUBV-24 and DUBV-25 sonars.

The DUBV-23 and DUBV-43 complement one another and comprise a single system. The former is equipped with a cylindrical transducer array mounted in a bulb-shaped bow housing, the latter with a variable-depth transducer array which can be set for operation between 50 and 200 m and may be towed at speeds ranging between 4 and 24 knots.

Both sonars operate in the low-frequency range (in the neighborhood of 5 kHz) and have four retunable standard frequencies. Their electronics are standardized, while some units, the target indication data output unit for the antisubmarine weapon system for example, are common to the sonar system as a whole. This affords the possibility of combining the operation of the two sonars in a variety of modes: employing them in combination in panoramic or sector scan modes with the synchronized operation of each on the same or different frequencies or using one for target tracking and providing target indication data output to the antisubmarine weapon system and the other for general surveillance of the area situation. Each sonar has an emission power of 96 kW and transmission durations of 4, 30, 150 or 700 ms. It has an effective range of up to 20 km (approximately 44 km according to other information).

The DUBA-25 all-round surveillance sonar with its hull-mounted transducer array operates on three standard working frequencies and emits audio signals or pulses with linear frequency modulation (which enhances the target-detection capability in areas with depths of up to 200 m where there is a significant effect from reverberation interference). It is one of the medium-range sonars (2.5-, 5.5- and 11-kilometer indicator positions) and is controlled by a single operator. Acquired data are computer-processed, indicator-displayed and transmitted to other shipboard systems.

In addition to that discussed above, NATO-member navies are also fitted with other hydroacoustical gear: communications systems, sound ray path plotters and so forth. According to foreign press reports, a number of new shipboard sonar systems are in various stages of testing or development.

Foreign specialists point out that despite the substantial increase in effective sonar range and the enhanced effectiveness and reliability which have been achieved in recent years, the problem of detecting submarines with shipboard sonar systems has still not been fully solved. One possible solution is considered to be the combined employment of ship-borne sonar equipment and the helicopters today carried on board virtually all ASW vessels. Resting with the helicopters is the responsibility of searching for submarines with the aid of sonobuoys (RGB) /radiohydroacoustical buoy/ or sonar systems submerged beyond the limits of the effective detection zone of ship-borne sonars. Data on the position of the helicopter and on the coordinates of the sonobuoys in place, as well as the data they acquire, are transmitted over automated communication lines to the ship where they are processed and analyzed. This information is generalized on the BIUS /not further identified/ underwater situation board in conjunction with data incoming from ship-borne sonar systems and other sources and utilized in the ship's antisubmarine weapon fire control system.

As it follows from foreign press reports, the primary areas for the further development of ship-borne sonar systems include the further automation of the procedures involved in processing and analyzing sonar signal data; target classification on the basis of these signals and establishment of the coordinates and components of target movements using digital computers; the integration of sonar systems with fire-control systems and BIUS; the combination of the processing of ship-borne sonar data with that from helicopter-borne sonars into a single system; and the widespread utilization of advances in modern technology, in particular of integrated circuits on solid-state components.



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